2017

M.Sc.

1st Semester Examination

ELECTRONICS

PAPER—ELC-101

Subject Code—27

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Mathematical Methods)

Answer Q. No. *1* and any *three* from the rest.

1. (a) State Cauchy's integral theorem. 2

(b) Show that Fourier transform of a Gaussian is also a Gaussian. 2

(c) Write Bessel's equation of order *n*. What do you mean by Bessel's functions ? 1+1

(d) Round off up to six significant figures. 4×½

(i) 24.564986

(ii) 27.483554.

(iii) 30.034653.

(iv) 21.565345.

(e) Find the inverse Laplace transform of $\frac{S^2 - 3S + 4}{S^3}$.

2. (a) State and prove the Convolution theorem in Laplace transforms.

(b) Evaluate $\oint_C \frac{\sin^2 z - z^2}{(z-a)^3} dz$, where the contour encircles the point z = a. (2+4)+4

3. (a) Find the Fourier sine transform of $e^{-|x|}$,

Show that $\int_0^{\alpha} \frac{x \sin mx}{1+x^2} dx$

$$= \frac{\pi e^{-m}}{2}; \quad m > 0$$

(b) Starting from

$$I = < f - \sum_i a_i \phi_i \mid f - \sum_j a_j \phi_j > \geq 0$$

derive Bessel's inequality $< f \mid f > \geq \sum_n |a_n|^2$ (2+3)+5

4. (a) Prove that the product of two Hermitian operators is Hermitian if and only if the two operators commute.

(b) Prove Parseval's theorem for the Fourier transform.

(c) Compute one root of $e^x - 3x = 0$, correct to two decimal places by Bisection method. 3+4+3

5. (a) Write down the geometrical interpretation of Trapezoidal Rule for numerical integration.

(b) Evaluate $\int_0^{\pi/2} \sqrt{\sin x}\, dx$, taking sin equal intervals, correct up to four significant figures, by Trapezoidal Rule. 5+5

6. (a) Solve the system of equations, by Gauss-elimination method.

$$2x_1 + 3x_2 + x_3 = 9$$
$$x_1 + 2x_2 + 3x_3 = 6$$
$$3x_1 + x_2 + 2x_3 = 8$$

Correct upto 3-significant figures.

(b) Compute y(0.2), from the equation $\frac{dy}{dx} = x - y$, $y(0)=1$, taking $h = 0.1$, by Runge-Kutta method, correct upto five decimal places. 5+5

[Internal Assessment — 10 Marks]